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The Development of an Interactive Video Aided Learning Module for Milling Machine Subject

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Abstract: The development of a comprehensive learning module has been one of the important learning materials to enhance student understanding during teaching and learning sessions. However, there was some evidence showing that technical and vocational students specifically faced difficulties catching up with the technical topics to master in the class, and the learning module seems to have improved. Thus, this study focuses on developing an interactive video-aided learning module for one of the technical subjects which are milling machine subjects to facilitate learning for milling machine subjects among technical and vocational students. The researcher used the ADDIE model as a guidance model in developing this learning module. There are five phases involved in the development of this learning module, namely, the analysis phase, design phase, development phase, implementation phase, and evaluation phase. In this study, the researcher used an expert validation form to obtain feedback on the suitability of interactive video-aided learning modules in terms of content, format, visual, and interactive video elements. A total of three experts consisting of vocational college lecturers in the field of industrial machining and university lecturers in the field of multimedia have been selected as the experts in evaluating the module validation. The data obtained from the three expert validations' will be analyzed using SPSS software. The result shows that the mean result for the entire module aspect analysis obtained a high mean value (M = 4.80) indicating strong positive agreement among the experts. In conclusion, this Interactive Video Aided Learning Module for the Milling Machine Subject can be used as a reference and guide in assisting better experience of the milling machine learning environment.

Keywords: Learning Module, Milling Machine, Interactive Video

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1. Introduction

Technical and Vocational Training Education (TVET) is a sector in which students may pursue their interests in practical learning and training. The relevance of TVET is the government's attempt to generate trained labour in the sector of industry, which contributes to the country's economic growth with international nations. Furthermore, there is a rise in job vacancies, student enrollment, and curriculum quality, allowing TVET courses relevant to national academic pathways. According to Jaludin, Zainal, and Nongkang (2019), TVET is an education that is primarily focused on producing highly trained local skilled labour and reducing reliance on foreign employees. According to the Malaysian Higher Education Development Plan (PPPM PT) 2015-2025, the ministry has developed collaboration with the industry to increase the quality of vocational education via improved teacher training, industry recognition, and industrial training placement.

Based on the Malaysian Education Development Plan (PPPM) 2013-2025, the government has implemented significant changes to the TVET delivery system by upgrading technical secondary schools and vocational secondary schools to Vocational Colleges and establishing several new vocational colleges in 2012. Programs offered at vocational colleges are listed in the Malaysian Skills Certificate (SKM) certification. For example, the Industrial Machining Technology program exposes students to the practice of machining workshops, engineering drawings, computer-aided design skills, and machine operation steps. The establishment of this institution can provide TVET educational opportunities as early as at the secondary school level and offer studies at the diploma level. The selection of students for vocational college admission consists of Form 3 Assessment (PT3) graduates who are interested in the field of skills. Establishing an institution such as KV aims to strengthen technical and vocational education as a skill area that is the primary choice in addition to academics (Omar & Ahmad, 2016).

According to Bahrom (2020), while preparing the teaching and learning process, instructors must consider selecting relevant resources to fulfil the requirements and skills of students before initiate the learning session. Instructors must provide a teaching assistance tool that students may use as a reference or unique guide to nurture dynamic learning opportunities that are uniquely appealing to students' preferences. A teaching assistance tool must include two components, namely the theoretical and practical aspects of the teaching and learning process.

Modules are comprehensive and methodical instructional resources that comprise a collection of learning experiences meant to assist students in achieving specified learning goals (Pratiwi, Hidaya & Aris 2017). Students and instructors may utilise modules to study, comprehend, and learn the processes they want to know. Modules may help generate interest and improve students' comprehension of a subject. This module differs differently from current modules as it promotes a more interactive way of learning using video assistance for practical learning and QR code application for more reliable extensive learning sources. Thus, this module may help students improve their expertise and abilities concerning the course topics covered in the module. A module may define the contents, objectives, and necessary skills. As a result, the module may contribute significantly to self-learning sessions or lectures, especially for the TVET learning environment.

1.1 Problem Background

Moving towards a developed country, the development of high-quality education must be taken seriously. It will help produce a generation of high-quality and skilled people in any field. Every teacher

also needs to use their creativity to ensure that the teaching materials they use are appropriate to students' abilities for a better learning experience.

According to the study of Hassan et al. (2017), there are still incomplete modules or notes that cover all topics especially for practical subject. This is supported by the study of Hussin and Marosadee (2019), state that there are modules that do not have a complete information, confusing and have relevance to other topics and difficulty in making comparisons. Moreover, learning notes nowadays just more to text and no graphic elements are included. This shows that students tend failed to learn a subject comprehensively from a visual aspect and it is difficult for students to find information on what they want to learn. Furthermore, students difficult to catch up with topics to be learnt and may result in poor psychomotor skills acquisition. Therefore, each instructor needs a complete and appropriate set of modules that can be understood by students to be used as a guideline in providing knowledge to students during the teaching and learning process.

The researcher has conducted a preliminary survey of two lecturers and three students from Kerian Vocational College's Industrial Machining Program. As a result, it was found that there were numerous difficulties arise during the process of learning to operate a milling machine. According to the survey, most students struggle to understand the milling machine subjects, which means that the information sheets are less specific in their content. Students frequently misplaced their learning sheets even after the learning session has finished. In practice, students are given the information sheets separately and not in their complete form. Furthermore, the information sheets are lack with demonstration videos for the practical work making it more difficult for students to understand it.

On the other hand, lecturers also face the similar problems such as missing module content and must depend on external sources to complete their learning. Moreover, lecturers face difficulties with an information sheet that lack of images, colours, and graphic features, making it harder for students to describe what they have learned and consequently reducing students' motivation.

Therefore, it is hoped that the development of this interactive video aided learning module for the milling machine subject able to help lecturers and students in applying technology in education and as well as nurturing positive impact on the teaching and learning process.

1.2 Objectives

There are three objectives in the study. The objectives of this study are to cover aspects such as:

1) Design an interactive video aided learning module for the subject of milling machine among industrial machining students at Kerian Vocational College.
2) Develop an interactive video aided learning module to facilitate the learning process of milling machine among industrial machining students at Kerian Vocational College.
3) Evaluate the suitability of interactive video aided learning modules in terms of content, format and visuals and interactive video elements.

2. Methodology

The research design was specifically adopted from ADDIE model and thus research procedure has been modified to meet the expectations of this study execution. This study has explored the use of the ADDIE model instead of other model in designing an instructional module for the subject of milling machine in vocational education. It was believed that this ADDIE model has demonstrated its efficacy in crafting compelling and successful instructional modules. Recent study conducted by Telaumbanua

(2023) had applied the ADDIE model to develop learning module and it was found to be highly effective and efficient in engaging and motivating students in their learning journey. The ADDIE model is a numerical teaching system design model in which each level is arranged systematically to be used as a guide for researchers. The term ADDIE is an acronym for Analysis. Design, Development, Implementation, and Evaluation. There are various models of module construction, but in this study the researcher chose to use the ADDIE Model as a guide to develop an Interactive Video Aided Learning Module for the Milling Machine Subject. Accordingly, the ADDIE model is a systematic design guidance model in module development. This is supported by Abu, Rashid and Saleh (2020), stated that the ADDIE model is a structured model that able to drive a complete teaching and learning practice for the purpose of development, evaluation and maintenance of teaching and learning situations or learning modules to achieve set learning objectives. This section will clarify the past literature study that has been referred in this study. ADDIE model is an important model to be discussed as it becomes an important element in module development. Moreover, past studies on module development that related to this study has been discussed further to seek any study gaps in terms of objectives, product design and development and as well as recommendations to be covered in this study. There are several past studies related to the development of machining operation modules and the application of technology in learning. These past studies to some extent provide guidance to researchers to see the extent of the importance of developing interactive video-assisted modules in this learning for students and teachers. Among the previous studies obtained such as Ardiyono, Akhyar and Efendi (2019), where the study applied the use of grinding machining operation modules through project-based learning in producing competent vocational students. The problem faced by the researcher in this study is teaching strategy that has been implemented seems to be more conventional ways. In addition, the less variety of learning material to be used makes it difficult for students to understand and results in incompetent students. Moreover, a study from Rahdiyanta et al., (2020) had examines the usability of interactive learning media in the manufacture of helical gears using grinding machines. It has been observed that the method of obtaining data through questionnaires is effective while the respondents are focused on media experts, teaching staff, students, and experts in media materials. It can be concluded that the interactive learning media makes helical gear material with a grinding machine suitable for use in student learning. Therefore, the researcher agreed that the development of modules with the help of interactive videos for grinding machines can help students and teachers of industrial machining at Kerian Vocational College in learning the topics of grinding machines. Moreover, the evaluation upon learning modules by related experts towards body of knowledge may provide effective validation for module evaluation.

This model includes five phases in a row, namely the analysis phase, design phase, development phase, implementation phase and evaluation phase. Therefore, this study has chosen the ADDIE model as a guide for the development of interactive video aided learning modules for milling machine subjects. Figure 1 shows the learning module development flow chart. The ADDIE model was used as a guideline in designing and developing this. Each phase in the model will be explained by the researcher in this section, which is the beginning of the analysis phase, design phase, development phase, implementation phase and evaluation phase.

2.1 Analysis Phase

This phase is the most important phase to collect all the problems related to milling machine learning. All data obtained will be collected and studied. The researcher has conducted a preliminary survey by conducting interviews with two lecturers and three students at Kerian Vocational College to gather all the information on the problems encountered in the learning of the milling machine. In addition, the researcher also made observations on the existing teaching materials used in the learning of the milling machine. As a result, this preliminary survey has embarked the needs of developing the

video aided milling module so that issues of student's difficulties to easily understand practical works in milling machine operation can be overcome by developing the proper documented module.

2.2 Design Phase

In the design phase, the researcher designed the content of the learning module based on the Vocational College Standard Curriculum (KSKV) and obtained module design confirmation from experts consisting of two KV Kerian lecturers to evaluate the module design in terms of layout, format, and module content. In addition, the researchers also designed three interactive video storyboards according to the content of the modules that have been validated by experts. As a result, the design of module has been finalized according to the advice by the experts that have been selected in this study.

2.3 Development Phase

This phase is the phase where the module development stage has been done according to the objectives in this study. In the development process, researchers have used editing software such as Microsoft Office, Power Point and Canva to produce writing and images for interesting module development. Next, for the interactive video the researcher has developed three interactive videos. In video editing work, the researcher has used Filmora Version 9 software to succeed in the video development process. In addition, researchers also make used the features in Powtoon software to create animated presentations and animated explanatory videos. The selection of the content of this module has been adopted and modified to meet the learning outcomes as expected for milling subject learning in TVET institution specifically for vocational college application.

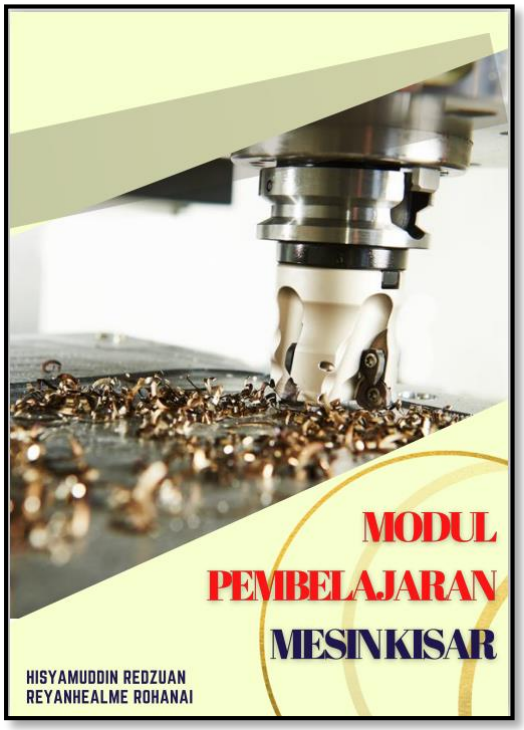
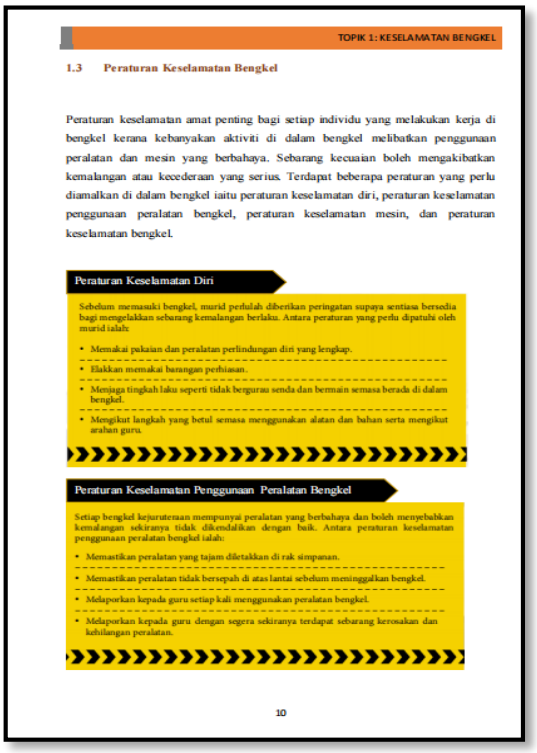


Figure 1: The example of module



TOPIK 1: KESELAMATAN BENGKEL

1.3 Peraturan Keselamatan Bengkel

Peraturan keselamatan amat penting bagi setiap individu yang melakukan kerja di bengkel kerana kebanyakan aktiviti di dalam bengkel melibatkan penggunaan peralatan dan mesin yang berbahaya. Sebarang kecuaian boleh mengakibatkan kemalangan atau kecederaan yang serius. Terdapat beberapa peraturan yang perlu diamalkan di dalam bengkel iaitu peraturan keselamatan diri, peraturan keselamatan penggunaan peralatan bengkel, peraturan keselamatan mesin, dan peraturan keselamatan bengkel.

Peraturan Keselamatan Diri

Sebelum memasuki bengkel, murid perlulah diberikan peringatan supaya sentiasa bersedia bagi mengelakkan sebarang kemalangan berlaku. Antara peraturan yang perlu dipatuhi oleh murid ialah:

- Memakai pakaian dan peralatan perlindungan diri yang lengkap.
- Elakkan memakai barangan perhiasan.
- Menjaga tingkah laku seperti tidak bergurau senda dan bermain semasa berada di dalam bengkel.
- Mengikut langkah yang betul semasa menggunakan alatan dan bahan serta mengikut arahan guru.

Peraturan Keselamatan Penggunaan Peralatan Bengkel

Setiap bengkel kejuruteraan mempunyai peralatan yang berbahaya dan boleh menyebabkan kemalangan sekiranya tidak dikendalikan dengan baik. Antara peraturan keselamatan penggunaan peralatan bengkel ialah:

- Memastikan peralatan yang tajam diletakkan di rak simpanan.
- Memastikan peralatan tidak bersepah di atas lantai sebelum meninggalkan bengkel.
- Melaporkan kepada guru setiap kali menggunakan peralatan bengkel.
- Melaporkan kepada guru dengan segera sekiranya terdapat sebarang kerosakan dan kehilangan peralatan.

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Figure 2: Module graphic

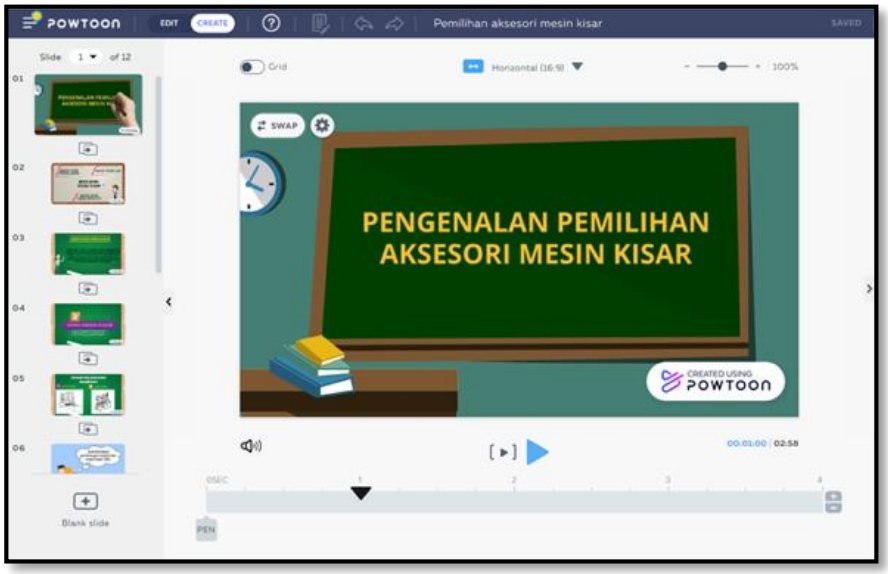

Figure 3: The development of interactive video using Powtoon software

2.4 Implementation Phase

The implementation phase is the fourth phase that has been applied in this study. In this phase, the module has been produced according to the settings that have been planned according to the needs of the students. Through this phase the process involved is the implementation and testing where the researcher will carry out a pilot testing for the lecturer on using the interactive video-assisted learning

module produced. If there are weaknesses, errors, and deficiencies through the development of this learning module, then the researcher will make improvements or remedial actions. Next in the evaluation phase, the researcher has proceeded with the expert's evaluation to test the suitability of the interactive video-assisted learning module. This implementation will use a Likert scale to evaluate the development of an interactive video-assisted learning module developed by the researcher.

2.5 Evaluation Phase

In this phase the researcher gained feedback from the validation experts in determining the quality of the learning modules developed and answer all the research questions. The selection of this experts in this study was rely on the random sampling technique targeted to specific location of TVET institution. In details, this study involves three (3) experts from TVET instructor who possessed a wide body of knowledge to the study topic's and had more than 5 years of teaching experience to evaluate the effectiveness of the module. According to Swanson & Falkman (1997), an individual can be recognized as an expert upon accumulating a minimum of five years' experience in their specific field and being acknowledged by colleagues or the organization where they are employed. Two experts in machining field have been chosen from vocational college and one expert has been selected from university lecturer. These experts need to evaluate the suitability of learning modules in terms of content, formats, visuals, and interactive video elements. The rate score given by the experts is then will be analyzed to validate the suitability level of the developed module to be used in the future practices by the students. This study can obtain data in percentage values, frequency, mean and standard deviation for each item for module suitability by using Statistical Package for the Social Sciences (SPSS) software.

2.6 Instrument Validity

The instrument in this study has been completely validated by three (3) validation experts consisting of lecturers from the Faculty of Technical and Vocational Education (FPTV), UTHM as to review the reliability of questionnaire item. Instrument validation was developed to ensure the usability of the study instrument for data collection from the development results of interactive video aided learning modules for milling machine learning. Practically, the modification of instrument has been done accordingly to experts advise. It was expected that this validation would help to ensure that the questionnaire used in this study is easy to understand and achieve the objectives of the study.

2.7 Module Assessment

In this study, the researcher provided an instrument that involved expert validation to evaluate the interactive video aided learning module for the milling machine subject. The experts involved include three lecturers, two lecturers in the field of industrial machining from Vocational College and one university lecturer in the field of multimedia. The design of this questionnaire has used five-point Likert scale and separated into five (5) section which is respondents demographics, item for contents of module, item for module format item for module visual, and item for interactive video elements. Extensively, the validity of the instrument for a questionnaire item has been emphasized as it is very important to determine whether the instrument item is reliable, meaningful, useful, and purposeful in representing study objectives. Moreover, this validity process also aims to ensure that the questionnaire to be distributed is easy to understand and achieve the objectives of the study. It was acknowledged that this questionnaire has undergoes validity checking from instrument experts consisting of there (3) lecturers from the Faculty of Technical and Vocational Education (FPTV) to review the questionnaire. As a result, the questionnaire has been revised as suggested and the final version of the questionnaire has been used for module evaluation.

3. Results and Discussion

Researchers obtained the values of percentage, frequency, mean and standard deviation for each item involving expert verification by using the Statistical Package for the Social Sciences (SPSS). For Part A, which is respondent's demographic background, three (3) experts were involved in this study consist of two (2) industrial machining lecturers and the one (1) multimedia lecturer to evaluate the suitability of learning modules in terms of content, format, visuals, and interactive video elements.

3.1 Module Content Analysis

Table 1 shows the results of the analysis findings from three experts for Part B, namely the content of the module. The content of the module is not repeated (Item 2), the content covers the requirements of teaching and learning planning of milling machine (Item 4) and the content of learning in parallel with the syllabus (Item 5) shows the same mean score value and standard deviation that is (M=5.00, SD=0). All three items showed the highest mean score values. While the lowest items are the questions posed in the module related to learning (Item 6) by obtaining a mean score of (M=4.00, SD=0). For the overall mean and standard deviation of the content of the modules that have been analyzed as much as (M=4.71, SD=0.24).

Table 1: Data analysis of module content

No.	Item	Frequency (*f*) / Percentage (%)					Mean	SD
		1	2	3	4	5		
1	The contents of the modules are arranged in an orderly manner.	-	-	-	1 33.3	2 66.7	4.66	0.57
2	The content in the module is not repetitive.	-	-	-	-	3 100	5.00	0
3	The content provided is relevant to the learning objectives.	-	-	-	1 33.3	2 66.7	4.66	0.57
4	The content covers the teaching and learning planning requirements of the milling machine.	-	-	-	-	3 100	5.00	0
5	The learning content is in line with the syllabus.	-	-	-	-	3 100	5.00	0
6	The questions posed in the module are related to learning	-	-	-	-	3 100	4.00	0
7	This developed module is suitable as a reference for milling machine students.	-	-	-	1 33.7	2 66.7	4.66	0.57
	Overall total						4.71	0.24

3.2 Module Format Analysis

Table 2 shows the results of the analysis findings from three experts for Part C that is the module format. For the neat module front page item (Item 1), the interesting module front page (Item 2), the use of font size (12) Times New Roman is suitable for use in the module and the spacing used for each line is suitable for use in the module shows experts strongly agree. The following four items obtained the same mean score and standard deviation that is (M=5.00, SD=0) indirectly indicate the highest mean score value. Next, for the descriptive items for each arranged in order (Item 5) and the module presentation layout arranged well (Item 6) obtained the mean score value and standard deviation equal to the value (M=4.66, SD=0.57). For both items shows the lowest mean value and the overall average

for the module format that has been analysed obtained a mean value and standard deviation of (M = 4.88, SD = 0.19).

Table 2: Data analysis of module format

No.	Item	Frequency (*f*) / Percentage (%)					Mean	SD
		1	2	3	4	5		
1	The front page of the module is neat.	-	-	-	-	3 100	5.00	0
2	The front page of the module is interesting.	-	-	-	-	3 100	5.00	0
3	The use of font size (12) (Times New Roman) is suitable for use in the module.	-	-	-	-	3 100	5.00	0
4	The spacing used for each row is appropriate for use in the module.	-	-	-	-	3 100	5.00	0
5	Descriptions for each topic are arranged in an orderly manner.	-	-	-	1 33.3	2 66.7	4.66	0.57
6	The layout of the module presentation is well arranged.	-	-	-	1 33.3	2 66.7	4.66	0.57
Overall total							4.88	0.19

3.3 Visual Analysis

Table 3 shows the results of the analysis findings from three experts for Part D that is the visual aspect of the module. The items of color use in this learning module are interesting (Item 1), the diagrams in this module are clearly visible (Item 2) and the sequence between each topic is well arranged (Item 3) showing all the experts chose strongly agreed. All three items obtained the same mean score value and standard deviation of (M=5.00, SD = 0). Accordingly, all three items showed the highest mean score values. For the item, the position of the diagram helps students to better understand learning (Item 3) and the position of the instructions for each step of the work is easy to follow (Item 4) also obtained the same mean score value and standard deviation of (M=.66, SD=0.57) directly indicates a low mean score value. For the overall average value of the mean score and standard deviation for the visual modules that have been analyzed as much as (M=4.86, SD=0.22).

Table 3: Data analysis of visual

No.	Item	Frequency (f) / Percentage (%)					Mean	SD
		1	2	3	4	5		
1	The use of color in this learning module is interesting.	-	-	-	-	3 100	5.00	0
2	The diagrams in this module are clear.	-	-	-	-	3 100	5.00	0
3	The position of the diagrams helps students to better understand learning.	-	-	-	1 33.3	2 66.7	4.66	0.57
4	The instructional position of each of the work steps is easy to follow.	-	-	-	1 33.3	2 66.7	4.66	0.57
5	The sequence between each topic is well arranged.	-	-	-	-	3 100	5.00	0
Overall total							4.86	0.22

3.4 Interactive Video Element Analysis

Table 4 shows the results of the analysis findings from three experts for part E which is the interactive video element. All experts chose to strongly agree for the video items provided are easy to understand (Item 1), the videos provided help in teaching and learning (Item 2), the duration of the videos provided is appropriate (Item 5), the video elements provided are appropriate to the level of knowledge students on related topics (Item 8), video preparation in topics is appropriate to students learning needs and access to video displays works well (Item 10). All six items obtained the same mean score value and standard deviation (M=5.00, SD=0) indirectly showed the highest mean score value. For the second highest mean score value is the item of use of clear green screen (Green Screen) (Item 3) of (M=4.66, SD=0.57). While the low mean score value on the item of use of audio that is clear to be heard (Item 4), the use of text in the video is clearly visible (Item 6) and background music does not interfere with concentration while watching the video (Item 7). All three items obtained mean and standard deviation scores of (M=4.33, SD=0.57). The mean of the overall mean and standard deviation of the interactive video elements that have been analyzed is (M=4.76, SD=0.22).

Table 4: Data analysis of interactive video elements

No.	Item	Frequency (f) Percentage (%)					Mean	SD
		1	2	3	4	5		
1	The videos provided are easy to understand.	-	-	-	-	3 100	5.00	0
2	The videos provided help in teaching and learning.	-	-	-	-	3 100	5.00	0
3	The use of green screen (Green Screen) is obvious.	-	-	-	1 33.3	2 66.7	4.66	0.57
4	Use clear audio to be heard.	-	-	-	2 66.7	1 33.3	4.33	0.57
5	The video length provided is appropriate.	-	-	-	-	3 100	5.00	0
6	The use of text in the video is obvious	-	-	-	2 66.7	1 33.3	4.33	0.57
7	Background music does not distract while watching a video.	-	-	-	2 66.7	1 33.3	4.33	0.57
8	The video elements provided are appropriate to the students 'level of knowledge on related topics.	-	-	-	-	3 100	5.00	0
9	The preparation of videos in the topic is appropriate to the learning needs of the students.	-	-	-	-	3 100	5.00	0
10	Access to the video display works fine.	-	-	-	-	3 100	5.00	0
	Overall total						4.76	0.22

The researcher chose the ADDIE model as a guide because it fits the learning design. The application of ADDIE model also has been used widely in module development and the application of ADDIE model can develop teaching materials for use in the learning process and more systematic to be applied (Martatiyana, Usman & Lestari, 2023). The module design created by the researcher during the design phase is referred to as module development after obtaining confirmation and views from experts before the module development process is implemented. Indirectly, the researcher can achieve the first objective of the study. For the module development phase, the researcher used words 365, power point

and Canva software to produce interesting modules. The researcher also developed three interactive videos using Powtoon software and Filmora Version 9. The researcher has selected three experts from industrial machining and multimedia to evaluate the suitability of interactive video aided learning modules for content, format, visual and interactive video elements. Thus, the second objective of the study can be achieved by the researcher.

Overall, the results of the analysis from the three experts show that this developed learning module is suitable for use by students in milling machine learning. This is because, the mean value that has been analyzed for all aspects of the module obtained as much as (M=4.80) while showing the mean value at a high level of agreement on module validation indicates that the developed learning module can helps to increase students learning experience. This result shows similarity to the study by Dalmon et al. (2011) where it was found that the interactive learning modules had increased middle and high school student's enjoyment concerning the applied engineering subject they were studying. Latest Study by Corral Abad et al. (2021) also claimed that interactive learning method can significantly support students and enhance the effectiveness of students' learning and satisfaction throughout the course contents. Throughout all this positive expectation, it was believed that this learning module capable to improve lecturers teaching effectiveness and nurture positive learning environment to the students.

4. Conclusion

In a nutshell, this interactive Video Aided Learning Module for the Milling Machine Subject has been successfully developed. As such, this learning module is developed through several processes starting from identifying problems to developing modules, designing modules and storyboards for the three interactive videos. Then the process of developing interactive modules and videos for the milling machine subject has been conducted until the module evaluation process is done. These processes also to some extent help researchers to produce learning modules as well. Therefore, the researcher hopes that this learning module can help teachers and students in teaching and learning sessions, especially the subject of milling machine. Validation and evaluation from knowledgeable experts in the related fields provides main indicator towards the successful of module validation. Future research undertakes may pofvide more interactive videos upon topics in milling machine subject and gather students real feedback for further evaluation on module effectiveness.

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